

Date: Monday, 3/26/2007 3:18:57 PM
 User: Kim Johnston

Process Sheet

Customer	: CU-DAR001 Dart Helicopters Services	Drawing Name	: BAR
Job Number	: 31466		
Estimate Number	: 10386		
P.O. Number	: <i>N/A</i>	Part Number	: D31961
This Issue	: 3/26/2007 S.O. No. : <i>N/A</i>	Drawing Number	: D3196 REVC
Prsht Rev.	: NC	Project Number	: N/A
First Issue	: <i>N/A</i> Type : MACHINED PARTS	Drawing Revision	: C
Previous Run	: 31273	Material	: <i>N/A</i>
Written By	:	Due Date	: 4/6/2007
Checked & Approved By	: <i>07.03.27</i>	Qty:	20 Um: Each
Comment	: Est Rev: A New Issue 05-11-08 JLM		

Additional Product

Job Number:



Seq. #:	Machine Or Operation:	Description:
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1.0	M6061T6B0750X01500	6061-T6 Bar .75" X 1.5"
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Comment: Qty.: 2.2922 f(s)/Unit Total : 45.8430 f(s)

Material: 6061-T6/T651 (QQ-A-200/8) or (QQ-A-225/8)

(M6061T6B0.750x01.500)

Identify for D3196-1

Batch: _____

*M104057 X 11 parts**M103961 X 9 Parts*

2.0	BAND SAW	BAND SAW
-----	----------	----------



Comment: BAND SAW

Cut blank: (0.75" x 1.50") x 26.200" long Bar

Er 0710404 X 9 parts

3.0	HAAS1	HAAS CNC VERTICAL MACHINING #1
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Comment: HAAS CNC VERTICAL MACHINING #1

1-Machine D3196-1 as per Folio FA339 and Dwg D3196 Identify as D3196-1

2-Deburr

Er / J.L 07104114

4.0	QC2	INSPECT PARTS AS THEY COME OFF MACHINE
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Comment: INSPECT PARTS AS THEY COME OFF MACHINE

Er / J.L 07104114

5.0	QC8	SECOND CHECK
-----	-----	--------------



Comment: SECOND CHECK

*J.F. 07104117**(20)*

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: D3196-1 PAR #: _____ Fault Category: _____ NCR: Yes ☒ No ☐ DQA: ☒ Date: 01/04/20

QA: N/C Closed: _____ Date: _____

NCR: <u>31466</u>		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			
07.03.04	3	1.100 DIM IS 1.084	UP 07.03.04 PC QS1042	PART ACCEPTABLE. DOES NOT AFFECT STRESS REPORT. fix program	07.03.04	07.03.04	UP 07.03.04 PC QS1042	07.03.04
08.07.07	3	C/SINK $\phi 0.610 \times 1.00$ Qty (2) AFFECTED	UP 08.07.07 PC QS1042	PART ACCEPTABLE REF DS EMAIL	N/A	08.07.07	UP 08.07.07 PC QS1042	08.07.07

NOTE: Date & initial all entries

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Customer: CU-DAR001 Dart Helicopters Services

Drawing Name: BAR

Job Number: 31466

Part Number: D31961

Job Number:



Seq. #:

Machine Or Operation:

Description :

6.0

HAND FINISHING1

HAND FINISHING RESOURCE #1



20X

Comment: HAND FINISHING RESOURCE #1

Chemical Conversion Coat as per QSI 005 4.1

M.L.

07/04/18

7.0

POWDER COATING

POWDER COATING



M101601

Comment: POWDER COATING

Powder Coat Grey Sandtex (Ref: 4.3.5.6) as per QSI 005 4.3

MS

0704-19

20

8.0

QC3

INSPECT POWDER COAT/CHEMICAL CONVERSION



Comment: INSPECT POWDER COAT/CHEMICAL CONVERSION

J. B. 07/04/20

20

9.0

PACKAGING 1

PACKAGING RESOURCE #1



Comment: PACKAGING RESOURCE #1

Identify and Stock

Location: _____

J. B. 07/04/20

20

10.0

QC21

FINAL INSPECTION/W/O RELEASE



20

Comment: FINAL INSPECTION/W/O RELEASE

07/04/20

Job Completion



U 07/04/20

W/O:		WORK ORDER CHANGES					
DATE	STEP	PROCEDURE CHANGE	By	Date	Qty	Approval Chief Eng / Prod Mgr	Approval QC Inspector

Part No: _____ PAR #: _____ Fault Category: _____ NCR: Yes No DQA: _____ Date: _____

QA: N/C Closed: _____ Date: _____

NCR:		WORK ORDER NON-CONFORMANCE (NCR)						
DATE	STEP	Description of NC Section A	Corrective Action Section B			Verification Section C	Approval Chief Eng	Approval QC Inspector
			Initial Chief Eng	Action Description Chief Eng	Sign & Date			

NOTE: Date & initial all entries

DART AEROSPACE LTD		Work Order:	31466
Description: Bar		Part Number:	D3196-1
Inspection Dwg: D3196 Rev: C		Page 1 of 1	

FIRST ARTICLE INSPECTION CHECKLIST

☒ First Article ☐ Prototype

Drawing Dimension	Tolerance	Actual Dimension	Accept	Reject	Method of Inspection	Comments
26.094	+/-0.010	26.094	/		Tape measure	
4.045	+/-0.010	4.042	/			
18.003	+/-0.005	18.000	-		Tape measure	
0.750	+/-0.005	0.745	/		mat. thickness	
1.500	+/-0.010	1.492	/		mat. width	
Ø0.344	+0.006/-0.001	0.344	/			
Ø0.660 x 100°	+0.008/-0.001 x 0.5°	0.660	-			
0.060 x 45°	+/-0.010 x 0.5°	0.060 x 45°	-			
0.750	+/-0.010	0.745	/		mat. thickness	
0.250	+/-0.010	0.245	-			
3.495	+/-0.010	3.494	-			
9.000	+/-0.010	8.998	-			
16.844	+/-0.010	16.844	-			
21.498	+/-0.010	21.498	-			
R0.125	+/-0.010	0.125	-			
1.100	+/-0.010	1.094	see back			
R0.125	+/-0.010	0.125	-			
0.444	+/-0.010	0.442	/			

Measured by: <i>E</i>	Audited by: <i>SA</i>	Prototype Approval:	N/A
Date: 07.04.04	Date: 07.04.04	Date:	N/A

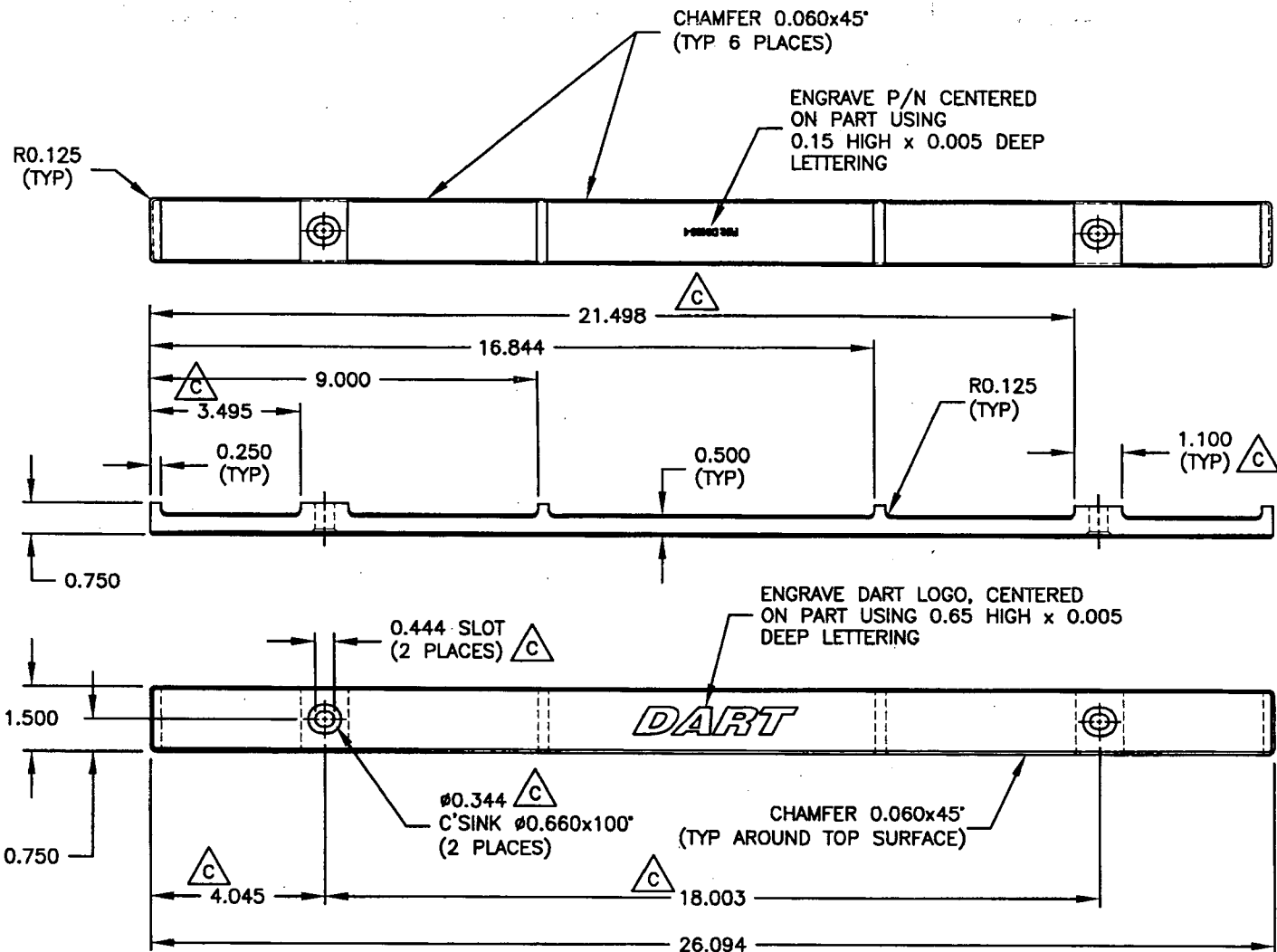
Rev	Date	Change	Revised by	Approved
A	04.04.20	New Issue	KJ/RF	
B	06.10.24	Dwg Rev. updated	KJ/JLM	
C	07.03.21	Dimensions updated per Dwg rev. C	KJ/JLM <i>JA</i>	<i>BE</i>

DART

RELEASED

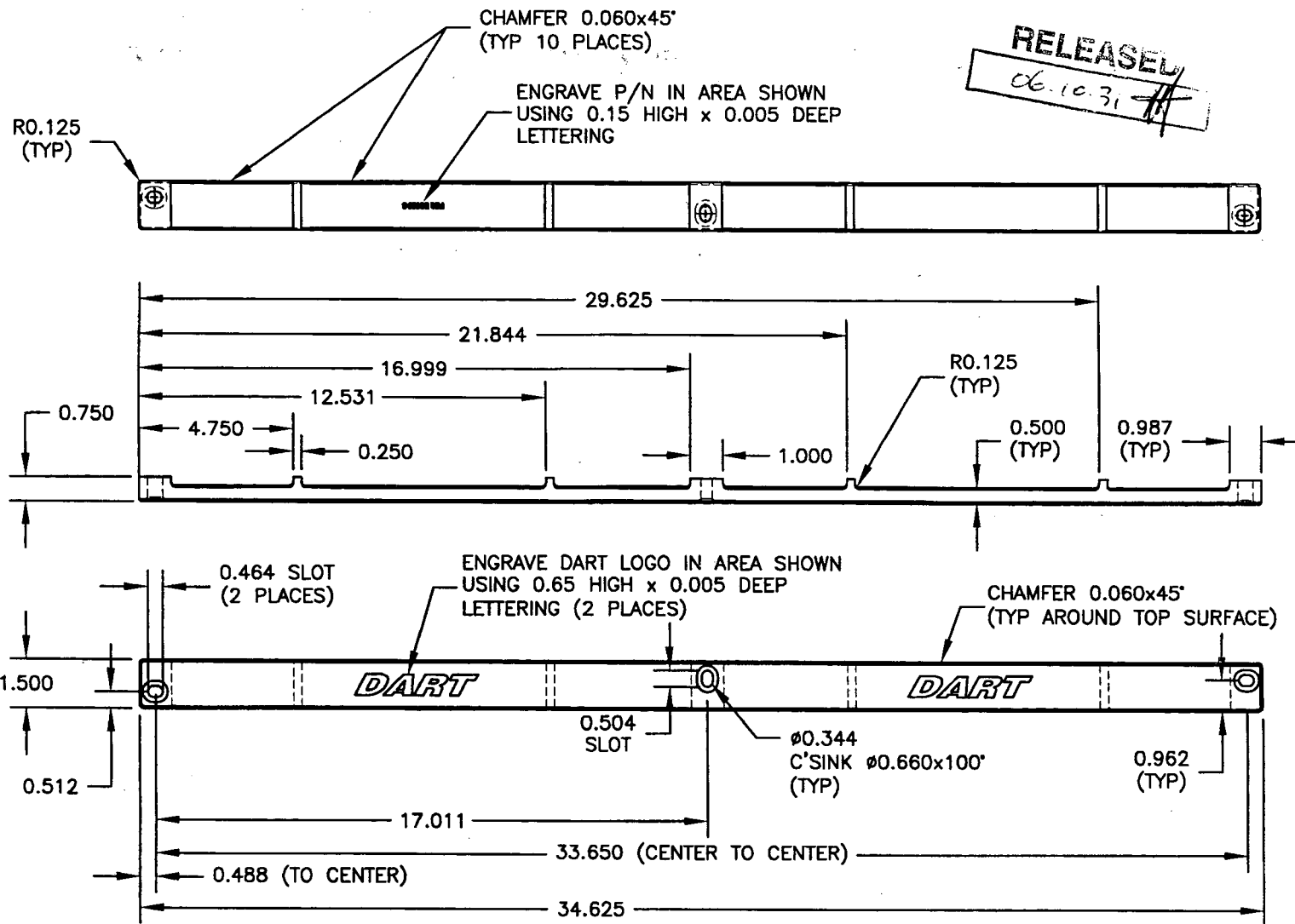
06.10.31

DESIGN	DRAWN BY	DART AEROSPACE LTD
40	JB	HAWKESBURY, ONTARIO, CANADA
CHECKED	APPROVED	DRAWING NO.
PH	JB	D3196
DATE	TITLE	REV. C
06.10.31	BAR	SHEET 1 OF 3
A	03.06.25	NEW ISSUE
B	06.09.25	ADD D3196-5
C	06.10.31	ADD SLOTS ON -1; REMOVED -5
SCALE		1:4

**D3196-1 BAR**

- 1) MATERIAL: 6061-T6/T651 ALUMINUM (QQ-A-200/8 OR QQ-A-225/8) (REF DART SPEC. M6061T6B)
- 2) BREAK ALL SHARP EDGES 0.005 TO 0.010
- 3) FINISH: ACID ETCH AND ALODINE PER DART QSI 005 4.1
POWDER COAT GREY SANDTEX (4.3.5.6) PER DART QSI 005 4.3
- 4) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED
- 5) ALL DIMENSIONS ARE IN INCHES

SHOP COPY
RETURN TO
ENGINEERING
UNCONTROLLED COPY
SUBJECT TO AMENDMENT
WITHOUT NOTICE
WORK ORDER
NO. 31466



D3196-3 BAR

- 1) MATERIAL: 6061-T6/T651 ALUMINUM (QQ-A-200/8 OR QQ-A-225/8) (REF DART SPEC. M6061T6B)
- 2) BREAK ALL SHARP EDGES 0.005 TO 0.010
- 3) FINISH: ACID ETCH AND ALODINE PER DART QSI 005 4.1
POWDER COAT GREY SANDTEX (4.3.5.6) PER DART QSI 005 4.3
- 4) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED
- 5) ALL DIMENSIONS ARE IN INCHES

NO. 31466
WORK ORDER
UNCONTROLLED COPY
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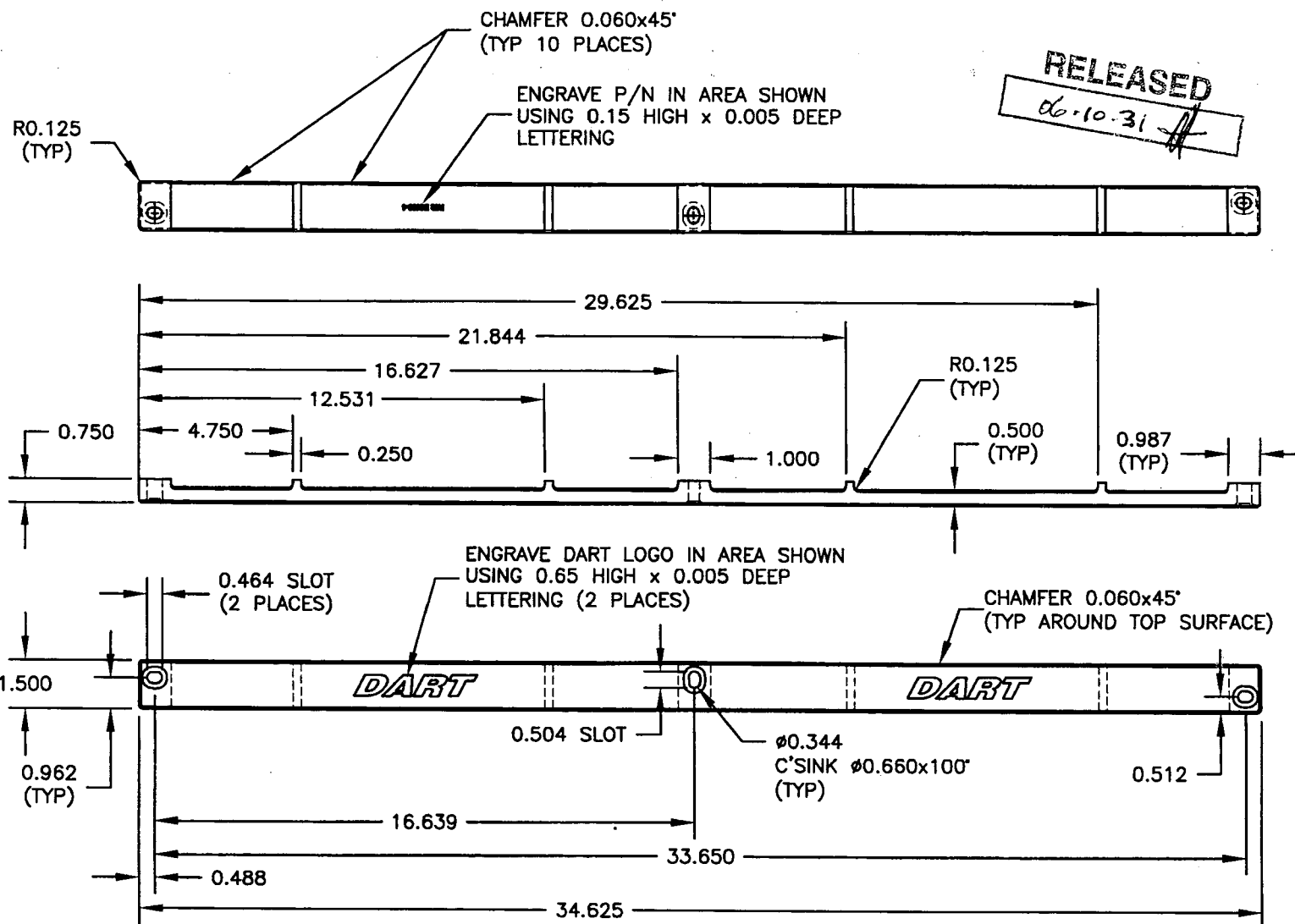
RELEASE
06.10.31

DART

DESIGN	DRAWN BY	DART AEROSPACE LTD
CHANGED	APPROVED	HAWKESBURY, ONTARIO, CANADA
DATE	TITLE	REV. C
06.10.31	BAR	D3196
		SHEET 2 OF 3
		SCALE 1:5

DART

DESIGN	DRAWN BY	DART AEROSPACE LTD
061031	061031	HAWKESBURY, ONTARIO, CANADA
CHECKED	APPROVED	DRAWING NO.
PH		D3196
DATE	TITLE	SHEET 3 OF 3
06.10.31	BAR	SCALE
		1:5



D3196-4 BAR

- 1) MATERIAL: 6061-T6/T651 ALUMINUM (QQ-A-200/8 OR QQ-A-225/8) (REF DART SPEC. M6061T6B)
- 2) BREAK ALL SHARP EDGES 0.005 TO 0.010
- 3) FINISH: ACID ETCH AND ALODINE PER DART QSI 005 4.1
POWDER COAT GREY SANDTEX (4.3.5.6) PER DART QSI 005 4.3
- 4) TOLERANCES ARE PER DART QSI 018 UNLESS OTHERWISE NOTED
- 5) ALL DIMENSIONS ARE IN INCHES

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SUBJECT TO AMENDMENT
WITHOUT NOTICE
WORK ORDER
NO. 31466

4.0 Analysis4.1 D3196-1/-3/-4 Bar Analysis4.1.1 D3196-1 Bar Bending Failure

The loading of the D3196-1 Bar is shown in Figure 1 of Appendix B. The worst case loading is the 16 g forward acting load because the magnitude of the load is higher and the section is smaller in the fwd-aft direction (16g) than it is in the up-down direction (4g).

$$b := 1.50 \cdot \text{in}$$

$$t := 0.50 \cdot \text{in}$$

$$k := 1.5$$

$$M := 2048 \cdot \text{in} \cdot \text{lb}$$

$$I := \frac{1}{12} \cdot b \cdot t^3$$

$$F_{bu1} := F_{tu1} + F_{o1} \cdot (k - 1)$$

$$M_u := F_{bu1} \cdot \frac{2 \cdot I}{t}$$

$$MS := \frac{M_u}{M} - 1$$

$$M = 2048 \cdot \text{in} \cdot \text{lb}$$

$$I = 0.01563 \cdot \text{in}^4$$

$$F_{bu1} = 48911 \cdot \text{psi}$$

$$M_u = 3057 \cdot \text{in} \cdot \text{lb}$$

$$MS = 0.49$$

Width of Section in Bending

Thickness of Section in Bending

Shape Factor (Bruhn C3.3)

Maximum Ultimate Bending Moment

Inertia of cross section

Modulus of Rupture (Bruhn C3.11)

Allowable Bending Moment (Ultimate)

Margin of Safety (Ultimate)

⇒ Thickness
does not
include tabs.
↳ length of tabs
does not
affect M.S.

07.03.09

4.1.2 D3196-3/-4 Bar Bending Failure

The loading of the D3196-3/-4 Bar is shown in Figure 2 of Appendix B. The worst case loading is the 8g sideways acting load because the magnitude of the load is higher and the section is smaller in the lateral direction (8g) than it is in the up-down direction (4g).

$$b := 1.50 \cdot \text{in}$$

$$t := 0.375 \cdot \text{in}$$

$$k := 1.5$$

$$M := 1180 \cdot \text{in} \cdot \text{lb}$$

$$I := \frac{1}{12} \cdot b \cdot t^3$$

$$F_{bu1} := F_{tu1} + F_{o1} \cdot (k - 1)$$

$$M_u := F_{bu1} \cdot \frac{2 \cdot I}{t}$$

$$MS := \frac{M_u}{M} - 1$$

$$M = 1180 \cdot \text{in} \cdot \text{lb}$$

$$I = 0.00659 \cdot \text{in}^4$$

$$F_{bu1} = 48911 \cdot \text{psi}$$

$$M_u = 1720 \cdot \text{in} \cdot \text{lb}$$

$$MS = 0.46$$

Width of Section in Bending

Thickness of Section in Bending

Shape Factor (Bruhn C3.3)

Maximum Ultimate Bending Moment

Inertia of cross section

Modulus of Rupture (Bruhn C3.11)

Allowable Bending Moment (Ultimate)

Margin of Safety (Ultimate)

Chris Provencal

From: David Shepherd [dshepherd@dartaero.com]
Sent: May 30, 2008 9:52 AM
To: 'Chris Provencal'
Cc: 'Mike Petsche'
Subject: RE: NCR D3196-1/-3/-4

Chris,

I agree with you. The parts are acceptable.
I wonder how they had the flexibility to screw around with the CNC program?
Guess we better make it crystal clear on the drawing.

David

From: Chris Provencal [mailto:cprovencal@dartaero.com]
Sent: Thursday, May 29, 2008 8:58 AM
To: 'David Shepherd'
Cc: 'Mike Petsche'
Subject: NCR D3196-1/-3/-4

David,

RE: D3196-1/-3/-4,

Checking into an NCR for some -3's they are currently making, I found out there has been confusion as to the direction of the 0.660 dim in the Ø0.660x100° c'sink. They were modifying the program to make the dim the other way, which made the c'sink too small.

I checked stock. We have some D3196-1 in stock, the c'sink on one is 0.664" (good), the rest are about 0.610" (min). The MS spec gives the range of screw head widths as 0.617 - 0.635, which is the 'sharp' dimension, ie the dim to keep the top of the head below the part surface (The edge of the head is chamfered, and the actual max diameter of the screw is about 0.590"). The two listed dims are from the same batch, so I think its more than just confusion over the dwg dim. I made an NCR to ensure the programs are correct, and to add a ref dim to show the direction of the 0.660" (or otherwise clarify it). Chances are, we've shipped a bunch like this.

I attached a bar to the a/c using MS24694-S154 screws, through the fireshield's metal grommet, and it bolted up OK.

I think the deviation is acceptable. Attached pics (one showing good, one bad) show that even though it may stick up slightly above the surface, the actual corners of the screw don't go past the edges of the c'sink. The belt shouldn't fray over this bolt as the bolt holes are located on the solid legs of the bar, and the belts don't go straight down, they'd be coming out to go over the occupant's shoulders. I would have them get the w/o's for these bars and sign of deviations using the 0.610" dim as the minimum allowable.

What do you think?

-Chris

2008-07-07